

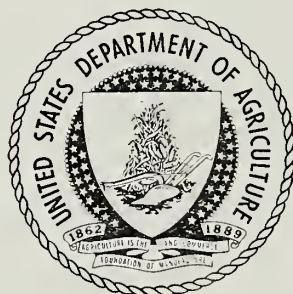
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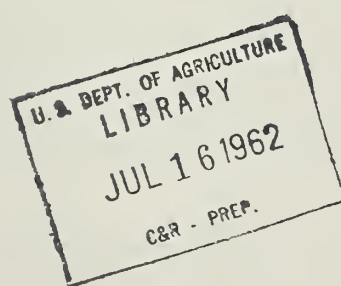


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THE FOREIGN AGRICULTURAL RESEARCH PROGRAM

of the

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE



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INTRODUCTION

The Foreign Agricultural Research Program was begun in 1958 under the authority of subsections 104(a) and 104(k) of U. S. Public Law 480, as amended (The Agricultural Trade Development and Assistance Act of 1954). Its purpose is to further research of mutual interest in agricultural sciences in many countries of the world. The types of research which may be undertaken include investigations in the utilization of agricultural products and the marketing of such products and projects concerned with farm, forestry, or human nutrition problems.

Grants are made to foreign institutions which can provide trained personnel with specialized experience and have adequate laboratory space and other facilities for conduct of the work to be undertaken. These institutions usually are non-profit institutions of higher education or non-profit organizations whose primary purpose is the conduct of scientific research. Grants are made to the research institutions that are to undertake research projects. Such grants are financed by foreign currencies which are available to the United States Government through sales of excess agricultural commodities abroad. The institutions may be located at any place in those countries where funds are available in the currencies of the country for the conduct of the program.

Research proposals may be submitted at any time. Because of the nature of the program and the review and approval process, several months are required to act upon a proposal and to get information back to the institution concerning the application. Information is returned to the institution just as promptly as possible.

Institutions interested in submitting research proposals for support from grants or contracts should prepare their proposals in accordance with the instructions and outline given on page 10. For further details see specimen research proposals in the Appendix.

AREAS OF RESEARCH INTEREST

Proposals may be submitted in any of the following broad fields of agricultural research: utilization, marketing, economics, plant and animal husbandry, forestry, and human nutrition. They must be of interest to both the United States and the country concerned. Those projects of applied research of interest only to the country concerned cannot be considered.

The following paragraphs will provide more detailed information on the types of research projects which may be financed under the Foreign Agricultural

Research Program. While the following descriptive material is illustrative only, it does cover the major areas in which research may be financed:

Utilization Research

Proposals for utilization research should be concerned with chemical and physical studies of a fundamental or applied nature, that will contribute to the development of new or improved uses for the major agricultural crops particularly cereal grains (e.g., wheat and corn), cotton, animal and vegetable fats and oils (e.g., soybean, cottonseed, and linseed oils, and tallow), dairy products, hides and leather, meat, sugar crops (e.g., cane and beet), wool, fruits and vegetables, and tobacco. Fields of work under which specific research proposals might be developed are illustrated by, but not limited to, the following examples:

Cereal Grains: (1) The development of new industrial uses for cereal starches and proteins through chemical conversion to tanning agents, plastics, protective coatings, and similar substances. (2) Biochemical conversion of cereal grain products into polymers useful as gums, sizing agents, films and fibers. (3) Fermentation of grains and grain products to produce industrial enzymes, vitamins, organic acids, and other products. (4) Development of improved milling methods for the economic separation of grains into fractions useful in food and industrial applications. (5) Fundamental research on the physical and chemical properties of wheats that are responsible for the baking properties of flours prepared from them.

Cotton: (1) Chemical and physical modification of cotton fibers and textiles to meet various industrial and household requirements. (2) Determination of the effects of finishing agents upon such fabric characteristics as resilience, crease-resistance, elasticity, draping and non-soiling properties. (3) Basic studies designed to increase the efficiency of processing cotton and to improve the quality of cotton products.

Fats and Oils: (1) Chemical conversion of vegetable oils to intermediates suitable for large-volume use in plastics, lubricants, and rubber-like materials. (2) Chemical conversion of inedible animal fats to synthetic resins, plastics, plasticizers, detergents, emulsifiers, water-repellent modifiers, lubricants, and other industrial products. (3) The development of methods for producing new, highly-stable edible fats having a wide range of physical properties and market applications. (4) The development of new non-food uses for the proteins contained in vegetable oilseeds.

Dairy Products: (1) The development of new or improved food products such as milk concentrates, milk powders, and cultured butter which will reduce perishability or the need for constant refrigeration without the sacrifice of nutritive value or flavor.

Hides and Leather: (1) Studies of the composition, structure, and chemical and physical properties of hides and skins, their components, and derivatives. (2) Development of more effective and economical methods for curing, processing, modifying, and tanning of hides (cattle, goat, and sheep) to produce leathers with new and improved properties and increased consumer acceptance.

Meat: (1) The development of new or improved methods for meat processing that will increase tenderness, preserve flavor, and result in greater utilization of lower-grade carcasses and less desirable cuts. (2) Research on new or improved methods for freezing meats and meat products to retain their quality.

Sugar Crops: (1) Chemical research on sugar and sugar derivatives to form new high-molecular-weight compounds of value as industrial intermediates. (2) The development of processes for the conversion of beet and cane sugar into organic acids having large-scale industrial applications.

Wool: (1) The development of wool fabrics that are shrink-resistant, color-fast and easier to clean and dry without sacrificing the desirable appearance or characteristics of present wool fabrics. (2) The development of chemical or mechanical methods of improving the quality of fabrics made from coarse wool.

Fruits and Vegetables: (1) Isolation and identification of constituents that are related to texture, flavor, color, and nutritive value of processed fruit and vegetable products. (2) Determination of changes in amounts and character of constituents as influenced by processing methods and environmental conditions. (3) Pharmacological and toxicological studies of food additives used in processed foods and of naturally-occurring constituents of fruits and vegetables.

Tobacco: (1) Development of improved tobacco products through identification of the chemical factors that influence the quality of tobacco and tobacco smoke. and the overall utilization of tobacco.

Marketing Research

Projects in marketing research should be designed to provide basic information on the maintenance, improvement and evaluation of quality of agricultural crops in marketing channels; or improved facilities, equipment, and work methods for handling agricultural products.

Quality Maintenance and Improvement: Information on physiological disorders, post-harvest diseases, metabolism, ripening occurring under varying conditions during transportation, storing, wholesaling and retailing of fruits and vegetables; determination of temperatures, humidities, packaging, use of artificial atmospheres, antibiotics, and other factors most effective in developing improved methods for reducing marketing losses in quality of all agricultural commodities; development and testing of methods for control and eradication of insect populations in stored agricultural products and observing their activity under varying conditions of natural habitats; appraisal of chemical residue problems occurring in U. S. agricultural products shipped abroad.

Quality Evaluation: Basic research to identify the factors constituting quality in agricultural products. Greater knowledge of the basic characteristics of quality would aid in the development of new or improved objective techniques and instruments for identifying and measuring product quality through physical, chemical, electronic, or other types of tests and analyses. The availability of reliable techniques for measuring quality will permit the refinement of grades and standards for agricultural products marketed abroad and will facilitate more precise grading to determine that the quality present is of the level required and claimed.

Packaging: Evaluation of suitability of packages and containers used for marketing local and imported agricultural products to determine resistance to mechanical damage, appearance, and effect on rate of cooling, metabolism, and spoilage of the packaged product.

Quality of U. S. Agricultural Products in Foreign Markets: There is occasional need to determine the quality of U. S. agricultural products in foreign markets and to analyze the type of quality deficiency in relation to the requirements of U. S. grade standards. Such quality surveys will aid in identifying weaknesses in U. S. standards which may require revision.

Engineering: Studies on refrigeration, air circulation and ventilation, insulation and other factors of efficient performance in facilities for storage and transportation. Also developmental research on more efficient equipment, work methods, and plant layout for grading, packaging and to perform the numerous handling operations required in marketing.

Conditioning, Handling, and Storing of Grain: Information is desired on new designs for grain storages including the type of construction, materials used, size and capacity, and special features to aid in conditioning and handling of grain in storages including:

- a. Underground grain storage: Information on shape, size, and capacity of storage, soil, topography, climatic conditions, types of construction and materials most suitable for such storages; methods and equipment for controlling temperature and moisture content of the grain; and limits of moisture content, temperature and other quality factors of grain going into storage.
- b. Hermetic or gastight storage: Type and construction of storage, methods of sealing storage, methods and equipment for loading and unloading storage and for controlling temperature and moisture content; and limits of moisture content, temperature and other quality factors of grain going into **such storage**.
- c. Conditioning and drying: Aeration of stored grain, drying grain with unheated air, with unheated air with supplementary heat, and with heated (over 20°F temperature rise) air; methods, techniques, operating practices and equipment used.

Agricultural Economics Research

Projects in agricultural economics research should be designed to provide basic information on the economics of farming, analysis of public food distribution, market structures, and practice and components of marketing margins.

Farm Economics: Studies of economic use of labor, land, buildings and equipment in farm production, and the adjustments in farming to technological development and changing market outlets; on problems of low production farms and areas; of agricultural financing, farm credit facilities, financing farm living and production, agricultural risk and insurance problems, and impact of taxation on individual farmers; and on problems of land and water use, land tenure and farm leasing.

Analysis of Public Food Distribution Programs: Analysis of the types and kinds of public food distribution programs used in various countries; specific purposes of such programs in terms of serving low-income groups, or other objectives; how food is distributed, form of distribution and forms of supervision; categories of people included in public food programs; methods of financing; and overall effect on food purchases of recipient families.

Market Structure and Practices: There are opportunities for increasing efficiency in the marketing of agricultural products in world markets through providing better market facilities and through improvements in market structure and practices. In some world markets surveys would be beneficial to determine the channels of distribution, the characteristics of firms engaged in marketing agricultural products and the facilities, handling practices and business practices used by the trade. The results should lead to increased efficiency in the markets and be of value to exporters of U. S. agricultural products.

Components of Marketing Margins for Foods: Measurement and analysis of marketing margins for food in the United States has resulted in increased understanding of the impact of changing economic conditions on the marketing system. Comparable research in foreign markets would establish the relative shares of labor, capital, transportation, profits and other components of marketing margins (difference between prices received by producers and prices paid by consumers) for selected agricultural products and countries considered to offer potential for U. S. export outlets. The results would be beneficial to the country concerned by identifying problem areas in need of greater efficiency, and will provide standards of comparison useful to U. S. exporters.

Farm Research

Projects in the field of farm research should aim to provide basic information that will lead to improved plant and animal husbandry. Projects in the following areas of farm research are of interest.

Soil and Water Conservation: Studies in the development of systems of soil and water management and conservation that will permit efficient, sustained and profitable use of soil and water; studies in soil chemistry, physics, microbiology, methods of cultivation, irrigation, crop rotation, factors affecting crops of high nutritive value, and soil-water-plant relationships; research in hydrology of agricultural watershed, stream and reservoir sedimentation, runoff, salinity control, and engineering aspects of drainage and irrigation; investigation of fertilizers and effective ways of manufacturing and using them.

Agronomy and Horticulture: Studies to develop crops with higher productive efficiency, better quality and resistance to diseases, insects, nematodes, heat, cold and drought; use of chemicals to control weeds, stimulate root formation on cuttings, prevent preharvest fruit drop, thin blossoming, promote ripening, and produce better flavor and nutritive qualities, investigation of the use of cultivation, competitive crops, pasturage, herbicides and other means of brush and weed control in cultivated crops, pastures and rangelands; introduction and testing of promising foreign species for domestic use; and studies on nematodes and plant growth.

Animal Husbandry: Studies in breeding to develop superior strains of meat animals with more rapid growth capacity, economy of gain, high fertility and quality of carcass; breeding of strains of dairy cattle that have longer periods of usefulness, higher production levels, and better adaptability to specific environment; develop sheep efficient in producing high quality meat and wool; develop strains of chickens and turkeys that excel in egg and meat production; and superior strains of fur-bearing animals raised in captivity. Investigation of the effect of feeding and nutrition variations on animal and poultry; the effect of animal and poultry breeding, feeding, management, age and sex on quality of meat, milk, and poultry products, wool, fur and other animal fibers. Studies of feeds, pasturage, animal nutrition, sanitary milk production, physiological aspects of growth, reproduction, infertility and lactation as they affect the general economic usefulness of farm animals; and the development of better and more economical feeding methods to produce animal products of high nutritional value.

Animal Diseases and Parasites: Studies to develop techniques for diagnosing bacterial, mycotic, viral rickettsial and other diseases; use of chemicals and biologics for combating diseases and parasites; studies of the chemistry and physics of diseases and ways that infectious ones are transmitted; investigations of the biology and habits of harmful parasites, including protozoa and helminths; the effect of parasites on animals and poultry, their

transmission and the development of effective treatment to eradicate or control them.

Entomology: Studies of the biology and habits of insects injurious or beneficial to agriculture; studies to determine methods for destroying, controlling or eradicating insects injurious to agricultural crops and livestock and for utilizing beneficial ones; studies of insects that annoy or affect the health of man or infest human habitation and the development of methods of controlling them; investigations of insecticides as a means of control, including residual action, methods and equipment for application and insect resistance to insecticides; and studies of biological, cultural and other methods of control.

Agricultural Engineering: Studies on the safe and efficient uses of farm power, labor, machines, structures and materials; on new and improved methods and equipment for tillage, planting, cultivation, protecting and harvesting of crops; new and improved methods and equipment for conditioning and preparing farm products for sale; on income producing uses of electrical energy on farms as power or as radiations that may beneficially affect plants and animals; on designing farm structures and their arrangements for greater strength, effectiveness, economy and more livable dwellings.

Human Nutrition

In general, proposals in human nutrition should seek to provide basic information that will lead to a better understanding of functions of and inter-relations among nutrients and of human nutritional requirements, the physiological utilization of nutrients from different classes of foods, and quantitative methods of determining nutrients in cooked as well as raw foods and food mixtures.

Projects include comparative investigations of the biochemical response to a uniform reference diet by persons of different races, nutritional status, and dietary backgrounds; studies of fat in nutrition--effect of type and amount of dietary fat and fatty acids; studies of carbohydrate in nutrition--effect of type and amount of dietary carbohydrates; studies of protein in nutrition--factors affecting requirements and comparative effectiveness of different foods or combinations of foods in satisfying protein requirements at different ages; studies of human energy expenditures in work under different environmental and nutritional conditions; studies of nutritive value of foods as prepared for eating and effect of household methods of preparation on food values.

Forest Research

Proposals in forest research should aim generally to provide basic information that will lead to improved forest resource management.

Forest Management: Research in forest genetics, selection or breeding of trees of superior wood quality, growth rate, adaptability to adverse conditions, resistance to disease and insects, determination of crossability patterns and causes for incompatibilities, new and improved breeding techniques including control of flowering; studies to determine the physiological and anatomical effects of growth regulating substances on forest trees and to screen promising substances and formulations for application; studies to determine the physiological responses and anatomical changes relating to vegetative growth and asexual reproduction of forest trees; to determine and evaluate the nutrient requirements of forest trees at all stages of development; studies leading to improved reforestation practice, stimulation of seed production, development of principles of productive forest tree seed orcharding; and the development of new and improved estimating techniques for timber volume and growth rate.

Watershed Management: Research on soil-water-plant relationships of forest and range lands; the processes of infiltration and percolation; groundwater depletion and replenishment; mountain stream channel mechanics; snow pack physics and management; soil erosion and stabilization processes; and watershed rehabilitation measures.

Range and Wildlife Habitat Management: Studies in the management and improvement of natural and seeded ranges associated with forest lands; the development of cover and food for big game and other wildlife; studies of the interrelationships of livestock-wildlife-and timber production and the harmonious integration of such uses; the evaluation of the inherent characteristics of forage plants (grasses, forbs and shrubs), their soil and climatic requirements, and relation to microsite factors; studies of seedling establishment, survival and resistance to grazing, drought and fire; and studies of the march of carbohydrates and proteins, particularly of game browse species as related to grazing use and environment.

Forest Products Utilization Research: Basic studies of the quality and physical properties of clear wood as influenced by environmental and growth conditions, anatomical features and chemical composition; and of the inter-related effects of external influences such as humidity, temperature, time, radiation, vibration, chemicals, or the like on physical properties. Basic studies of the effect of processing variables such as those involved in machining, veneer cutting, preservation or fire-retardant treatment, drying

processes, and laminating or cross-laminating, including adhesives and fundamentals of adhesion. Basic studies involving structural application and engineering principles in the use of wood and wood products as, for example, improved or radically new structural systems and fastenings. Basic studies involving chemical utilization of wood; characterization of lignin and development of lignin-based chemicals; conversion processes for cellulose, including pulp and paper, glycerols, yeast, or other chemical products.

Forest Economics: Studies in forest production economics involving costs, returns and profitability of alternative timber production and protection measures on different sites; economic evaluation of competing and multiple uses of forest land to guide selection of optimum use or combination of uses; effects of ownership, taxation and other economic factors on the practice of forestry and possible means of overcoming economic obstacles to efficient growing and harvesting of timber. Also the development of improved forest inventory techniques and procedures.

Forest Fire: Studies to identify, measure and predict the variable characteristics of fire in wild land vegetation that cause different fire effects and different problems of prevention, control and intentional fire use, including analytical and experimental research in the basic nature of combustion, in physics, heat transfer, meteorology and associated fields necessary to relate forest fire behavior with combinations of weather, fuel and topography that constitute forest environment; studies of human behavior and physical measures, including lightning prevention, aimed at reducing numbers of forest fires; development of improved fire control systems, methods and techniques of fire control and fire extinguishment to reduce burned acreage; development of improved techniques for appraising or evaluating the effects of fire, and new and improved techniques for using fire intentionally to reduce fire hazard or to produce other land management benefits.

Forest Insects: Basic studies of the life histories and habits of bark beetles, defoliators, and other insects destructive to forest trees and to forest products and wood in use; investigations of chemical, biological, cultural and other methods to suppress damaging populations; studies of biological and environmental factors that regulate the rise and fall of outbreaks of destructive insects in forest stands; research in forest genetics to develop improved strains of trees that are resistant or immune to insect attack; studies in insect physiology to determine the underlying principles of insect attraction and host selection; research on new and improved methods and equipment for the direct control of insect outbreaks on forest trees and in forest stands, including aerial application of toxic sprays, aqueous suspensions of virus organisms, and systemic insecticides; and fundamental studies of insect toxicology, ecology, genetics, nutrition and climatology.

Forest Diseases: Identification and life histories of fungi or other pathogens causing diseases of forest trees. Especially interested in fungi known to cause diseases of American forest trees and fungi causing diseases of native trees closely related to North American tree species. Determination of effective preventive or control measures for important tree diseases. Studies of the basis for forest tree resistance to specific diseases to guide tree improvement programs. Research on the role of mycorrhizae in disease prevention, particularly with reference to root diseases of forest trees. Determination of relative susceptibility to decay of native woods important in international trade.

PREPARATION OF A PROJECT PROPOSAL

Proposals should be written in English, using the following outline. Ten copies of each proposal are required. See Exhibit A for specimen proposals.

1. Title
Give brief but clear title of proposed investigation.
- 2a. Name
Name and address of institution and the name of director. Give a brief history of the institution and its organization and available research personnel and facilities, physical plant, library, etc., which could contribute to the proposed research. Attachment of available general information bulletins is suggested.
- 2b. Department or Laboratory
The name of the head of the department, and brief experience history if he is not the principal investigator of the proposed project, the number and type of employees, and any special equipment, facilities or experience which would particularly qualify the laboratory or department to carry on the proposed research.
- 2c. Principal Investigator
The name of the principal investigator for the project, his educational background and experience, publications relating to the type of research proposed, and any additional information concerning his qualifications for this particular research.
- 3a. Objective
Give summary statement of objective or objectives of the investigation.
- 3b. Importance of Investigation
Provide information concerning the importance of the investigation from the standpoint of its contribution to basic knowledge or to the solution of a practical problem, including mention of the relation of the work to previous studies in the field and to other current studies now going forward at the proposing institution or elsewhere if known.

3c. Plan of Work

State clearly how the study would be conducted. A well prepared plan of work is essential to the appraisal of a research proposal.

4a. Duration

Give the duration of the proposed project. The maximum period for any project is five years.

4b. Scientific Personnel Assigned

Give an estimate of the number of man-years per year of professional and technical assistance required to accomplish this research. For example, if the principal investigator planned to spend 1/4 of his time on the project and he had 2 full-time technical assistants and one half-time technical assistant, the total would be 2 3/4 man-years per year.

5. Cost Estimates

Make estimates for the total period of grant in currency of the country. Break estimates of costs down into the following cost categories. In some instances one or more of these categories will not be involved in a particular proposal. In such cases, the fact that no cost is involved should be indicated. Cost estimate forms such as shown in Exhibit B may be useful in developing these estimates.

(a) Salaries and Benefits

List salaries for professional employees, for technical assistants, and for others, including temporary or part-time employees in field or laboratory. Include as salary any benefits such as pension plans, cost of living allowance and insurance. Under this heading should be included the estimated cost for personal services of all employees who will work directly on the project.

(b) Travel Within Country

Give estimated cost for transportation of people, including per diem and other travel costs.

(c) Travel Outside Country

Include justification for any proposed travel outside of country that is considered essential to the project.

(d) Transportation of Things

Give estimated cost of shipping materials or supplies essential to carrying on the proposed research.

(e) Rents

Estimates of such costs are applicable only when land, buildings or equipment are to be rented or leased from other persons for the project.

(f) Other Contractual Services

Cost of work that will be done on a contractual basis outside of the institution, such as special analyses, statistical services, and publication of research results.

(g) Supplies and Materials

A reasonable estimate of the cost of expendable laboratory, field, and office supplies needed to carry on the proposed research.

(h) Other Direct Costs

Any additional proposed costs directly attributable to execution of the research project and not included in any other direct cost estimate. Full identification should be stated.

(i) Indirect Cost Allowance

This allowance is to provide for indirect costs that cannot reasonably be allocated to direct cost. It includes indirect expenses for general administration and support, building maintenance and use, char services, typing and secretarial services not otherwise estimated, library use, general heat, light and telephone services, postage except for parcel post mailings, and any indirect cost of a general nature. Give estimate as a percentage of total of items (a) through (h) excluding (c) or as a lump sum.

(j) Non-expendable Equipment (Capital Assets)

This comprises personal property of a more or less durable nature and costing more than the foreign currency equivalent of \$100. Any special equipment not reasonably available to the institution and proposed to be purchased for use on the research must be fully identified and the cost shown for each item. It is expected that the institution will share the cost of proposed equipment having a reasonably useful life beyond the duration of the project.

TOTAL

SUBMISSION OF PROPOSALS

The Foreign Agricultural Research Program is under the supervision of the Director, Foreign Research and Technical Programs Division, Agricultural Research Service, U. S. Department of Agriculture, Washington 25, D. C. Regional offices are located at Rome, Italy, and New Delhi, India. All proposals and subsequent correspondence originating from research institutions located in Europe and the Near and Middle East should be addressed to the Director, European Regional Research Office, American Embassy, Rome, Italy, but transmitted through the Agricultural Attache, American Embassy, of the country in which the research institution is located. All proposals and subsequent correspondence originating from research institutions located in the Far East and Asia should be addressed to the Director, Far Eastern Regional Research Office, American Embassy, New Delhi, India, in care of the Agricultural Attache, American Embassy, of the country in which the research institution is located. Proposals from South American countries or other countries not serviced by these two regional offices should be addressed to the Director, Foreign Research and Technical Programs Division, Agricultural Research Service, U. S. Department of Agriculture, Washington 25, D. C., in care of the Agricultural Attache, American Embassy, of the country in which the research institution is located.

APPRAISAL OF PROJECT PROPOSAL

Every proposal received from any foreign institution proposing the establishment of a grant to conduct research under the Foreign Agricultural Research Program is given careful consideration by the Department of Agriculture. It is first reviewed by a Policy and Program Development Board which determines what unit within the Department of Agriculture is conducting research similar to that proposed by the foreign institution. The research proposal is then forwarded to the proper unit of the Department of Agriculture where it can be reviewed by a group of technical specialists familiar with the type of research being proposed.

The purpose of such a review is to ascertain whether the proposal has benefits both for the country from which it is received and for the United States, to make certain that the work proposed does not duplicate other research that has been performed or which is in progress and for the purpose of coordinating the research proposal with other research known to be in process in the United States or elsewhere.

The result of such a review may be acceptance of the proposal as it is submitted by the foreign institution. It may result (1) in suggested modifications which would make the results more broadly applicable, (2) in suggestions for the use of new or different techniques with the thought that such modification would produce more valid or rapid results, or (3) in the proposal being turned down as not meeting the criteria established for research under this program. In some cases scientists in the Department of Agriculture will wish additional information from the institution making the proposal before rendering a decision concerning approval or disapproval of the proposal.

All proposals which have been modified in the appraisal process are returned to the originating institution for further consideration. If the originating institution concurs in these modifications, the proposal is approved. The approved proposal is then used to negotiate a grant if funds are available.

GRANT NEGOTIATION

Representatives of the United States Department of Agriculture will visit an institution when a grant for a project is to be negotiated. One of the representatives will be a technical specialist who is in a position to discuss the technical aspects of the work and the other will be an administrative officer to discuss administrative and fiscal matters.

The purpose of this visit is to discuss with the representatives of the institution the procedures which will be followed in carrying out the research, to ascertain definitely what personnel, equipment, and facilities the institution proposes to utilize in carrying out the research, to familiarize the institution with the procedures necessary in the conduct of the program, and to determine the amount of funds needed to finance the project satisfactorily. Such visits by representatives of the United States Department of Agriculture present an opportunity for representatives of the institution to make known any questions which they may have regarding the program and to secure information which may be useful in conducting the research.

PAYMENT TO GRANTEE INSTITUTION

Grants under this program are made for fixed total amounts to meet estimated cost for the duration of the project. Payments are made semi-annually to the institution for the period of the grant. The duration of a grant may not exceed five years. An initial payment is made at the beginning of the grant to cover estimated cost for an agreed period. Semi-annual reports of expenditures and reports of research progress including an estimate of financial needs for the next six month period are required from the institution. On the basis of these reports, a further payment is authorized to carry out the purposes of the research. Payments are always in the currency of the country where the institution is located. Examples of the reports requested from the grantee are given in the Appendix.

GENERAL PROVISIONS APPLICABLE TO FOREIGN AGRICULTURAL RESEARCH GRANTS

General provisions have been developed which are applicable to all grants under this program. These general provisions are always discussed whenever a grant is negotiated. It is important that these provisions be understood fully since an institution must agree to these provisions in accepting a grant. The points included in these general provisions and a brief explanation of each point are as follows:

(1) Funds advanced pursuant to this grant will be placed in a special account and used only for the purposes outlined in the proposal identified in the attached grant letter dated

A separate account for recording charges against the grant fund in support of the particular project is intended by the provision. This may be a special bank account or a separate ledger account. Receipts for expenditures chargeable to the grant fund should be marked and separately kept for review at a later date. The grant funds are to be used only for the approved proposal which has been accepted by the USDA. If a special bank or deposit account is used to keep the payments made under the grant, any interest payments or premiums for such account must be reported in connection with the fiscal reports. Any interest earned thereunder must be returned to the U. S. Treasury.

(2) The maximum obligation of the United States Government under this proposal shall be limited to

The maximum obligation of the United States Government is the total amount of the grant specified in the grant letter and this amount may not be exceeded. However, except for capital assets (usually non-expendable equipment) and travel outside the country, the amounts estimated under the various categories of expenses at time of negotiation are not limitations on use of grant funds for such categories and the amounts may be shifted for meeting necessary expenses in other categories. In case capital assets or travel outside the country items are not required, those amounts considered at the time of negotiation may then also be used for other categories.

(3) This project shall be completed within years after the date on which the attached grant letter is signed and dated by your organization.

The project duration may not exceed five years. The beginning date of the project and the first date from which any obligation may be recognized as chargeable against grant funds is the date when the grant letter is accepted, that is, signed and dated by the research institution unless some other specific date is provided in the grant letter or by an amendment thereto.

(4) An advance payment will be made as soon as possible after acceptance of the attached grant letter by the grantee.

Advance payments authorized under the grant will be made through the American Embassy to the grantee institution. All payments will be made in the currency of the grantee country. Upon specific election of the research institute, payment may be made upon a basis of reimbursement of expenses incurred by an institution rather than through the system of advance payments.

(5) Except for the initial period, the report for this project will be six calendar months ending on of each year. The grantee shall furnish to the Agricultural Research Service as soon as possible after each report period: (a) a fiscal report which will show the actual amounts of money expended by the grantee in behalf of this proposal and which will include an estimate of financial needs for the following report period supported by an explanation of significant changes in financial requirements anticipated for specific purposes; and (b) a descriptive narrative progress report of the scientific aspects of the research clearly indicating significant factors with respect to the progress of the work, the second of such reports each year to be an annual summary of the work done, giving any important technical developments achieved during the year and outlining plans for the year ahead. Based on the conclusions reached as a result of the evaluation of these reports, a progress payment will be made for the next report period in an amount consistent with the estimated rate of expenditure as indicated by these measures.

Reporting requirements are established for a period of each six months. Exceptions are the first period, which is from the date the grant was accepted to the first specified reporting date. Preferred reporting dates may be specified by the research institution. A total of four reports are required per year, two related to the progress of the research and the other two relating to funds expended during the reporting period. An estimate of financial requirements for the next succeeding period must be included on the fiscal report relating to funds expended during a reporting period. Forms for reporting research progress and fiscal data will be furnished to the grantee together with a letter of instructions at the time an advance payment is authorized. After the first advance payment has been made no further payments will be authorized until such time as the institution has submitted the required research progress and fiscal reports including the estimate of financial requirements.

(6) Should there remain in the possession of the grantee an unexpended balance in this project at the end of the grant period or the termination of the project, whichever comes first, this amount will be returned to the Director by the grantee without demand.

Any funds in the hands of the grantee at the close of the period specified in paragraph 3 or upon termination of the grant shall revert to the United States without demand.

(7) Currency Revaluation. It is recognized that during the period this project is in effect official action may be taken to revalue the medium of exchange within the country in which the research is being conducted. This will have a direct bearing upon the amount of work which can be performed with the money to be provided by this grant. Therefore, should the value of the internal foreign currency fluctuate not more than ten percent, either up or down, as a result of an official revaluation an appropriate adjustment in the remaining work program will be worked out mutually. Should the

plus or minus fluctuation exceed ten percent an appropriate adjustment in the program may be worked out mutually or either party may call for a readjustment of the program costs for the incompleting portion thereof.

In the event revaluation of the local currency would have a significant effect on the costing of the research, the financing for the project may be adjusted through mutual agreement. This might be done by providing additional local currency if available, by reducing the period of the grant, or by any other modification that is mutually acceptable. Generally, this would be handled by renegotiation of the grant.

(8) Records and Reports. In addition to any records and reports specifically mentioned above, the grantee shall furnish a final report in a form suitable for publication including all pertinent technical data, summarizing the work done, the results accomplished and the conclusions drawn therefrom. The grantee shall maintain such records as may be required and shall furnish such reports with respect to the status and progress of the project as the Director shall require. All reports and other communications should be transmitted in English. However, should the Director determine that this is not feasible, reports shall be prepared in the official language of the country in which the research is being conducted.

A final comprehensive report of the research accomplishments under the project is required to be made by the grantee institution. The current requirement is for fifty copies of such final report.

(9) Access to Facilities, Records, and Accounts. Accredited representatives of the U. S. Government shall have access at any reasonable time to the plant, laboratories, offices, or other facilities utilized in connection with the project, for purposes of review and observation of the status and progress of the project, and all data, information, records, reports, and accounts of the grantee relating to the project shall be made available to these representatives and all such data, information, records, reports, and accounts shall be maintained available for inspection a minimum of two years beyond the termination date of this grant. Officers and employees of the grantee, or other personnel, assigned to or engaged in the conduct of the project shall be available for consultation with such representatives at any reasonable time.

The provisions of this paragraph are designed to assure the right to review the progress of the work under the grant and the records pertaining only to the grant.

(10) Research Assistance. No contract, grant or other arrangement shall be made by the grantee with any other party for performing all or any portion of the project without advance written approval of the Director.

Subcontracting of the research is intended to be prohibited by the language. Such language does not prevent contracting for special analytical services or other limited services requiring use of specialized equipment or personnel outside of the grantee institution.

- (11) Official travel performed by grantee's representatives in connection with this grant outside of the country in which the research is being performed must have advance written approval of the Director.

Grantees are permitted to perform the travel necessary to prosecute a research project effectively. Travel within the country in which the grant is made is expected to conform with the travel policy of the institution. Travel between foreign countries within a specific Region, for example Europe and the Middle East is approved by the Director, European Regional Research Office, Agricultural Research Service, Foreign Research and Technical Programs Division, American Embassy, Rome, Italy, and for Asia and the Far East the Director, Far Eastern Regional Research Office, Agricultural Research Service, Foreign Research and Technical Programs Division, New Delhi, India. Travel outside a Region or to the United States is approved by the Director, Foreign Research and Technical Programs Division, Agricultural Research Service, U. S. Department of Agriculture, Washington 25, D. C. Proposals by persons in South America for travel outside the country of the grantee institution also should be directed to the above address in Washington, D. C. Any foreign travel to be charged to grant funds must have the advance written approval as indicated.

It is required that all requests for travel by grantees to foreign countries be supported by a justification statement. This statement is primarily an explanation of why the travel is necessary for the effective prosecution of the research project.

- (12) The negotiation of this project included certain provisions for the procurement of specific items of non-expendable equipment (list of equipment attached) which cannot be modified except by advance written approval of the Director.

As used here the term "non-expendable equipment" has been defined broadly as comprising property of a more or less durable nature and costing more than the foreign currency equivalent of \$100 for each item, excluding duties, taxes, transportation or installation costs. The term includes non-expendable equipment, furniture, fixtures, sets of books for permanent collections, machinery, instruments and apparatus, non-permanent type structures and greenhouses.

Equipment specially required for the project and not at the institution or reasonably available to it may be financed from grant funds. Any non-expendable equipment proposed to be purchased must be determined at the time of the technical and fiscal negotiations to be recognized in the original determination of the maximum amount of the grant. After

acceptance of the grant no purchases of additional non-expendable equipment may be made without the prior written approval of the director of the appropriate regional office or the director of the Program in Washington, D. C. Purchase of additional non-expendable equipment may be authorized but the cost must be absorbed within the grant total and no additional funds will be made available for this purpose. Use of grant funds for construction of permanent type buildings normally will not be authorized. Grant funds may not be used for purchase of land.

- (13) Covenant against Contingent Fees. The grantee warrants that no person or selling agency has been employed or retained to solicit or secure this grant upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the organization for the purpose of securing business. For breach or violation of this warranty, the Director shall have the right to annul this grant without liability, or, in his discretion, to deduct from the grant amount or consideration the full amount of such commission, percentage, brokerage, or contingent fee.

These provisions are designed to prohibit the payment of commissions or fees in return for obtaining a grant at an institution. This provision is required because of the United States laws and regulations relating to federal agreements and contracts.

- (14) This grant may be terminated at any time by mutual agreement of the grantee and the Director or by the Director alone. In the event of termination, the grantee shall furnish a report as required by the Director, summarizing the work done, the results accomplished, and the conclusions resulting therefrom. The Director shall have payment made, upon presentation of proper claim, for the cost of the work performed by the grantee at the time of such termination, less any funds previously paid, and shall not be liable for any further claims; provided the claim submitted by the grantee shall not exceed the amount of total obligation stated in the grant. For this purpose cost will include such costs as were considered chargeable to this grant at the time of its negotiation. In the event of termination, any payments made to the grantee for which services have not been rendered by the grantee shall be returned to the Director.

Grant termination may be requested by the research institution or by the Director of the Foreign Research and Technical Programs Division for good cause. The cause may include loss of the principal investigator without a satisfactory replacement, loss of necessary facilities by grantee institution, lack of reasonable technical progress, failure of grantee to live up to commitments or other conditions making it unfeasible for the grantee to continue with the project. In the event of termination it may be necessary that up to 50 copies of the final report of the research results be furnished. Appropriate settlement agreements looking towards disposition of non-expendable equipment and funds will be conducted in the event of termination.

(15) Personal Benefits. No member or other delegate to the United States Congress, or a United States resident commissioner, shall be admitted to any share or part of this grant or to any benefit that may arise therefrom, unless it be made with a corporation for its general benefit.

This provision is required by reason of United States law.

(16) Patent Provisions and Publication of Results. The public shall be granted all benefits in the United States of America of any patentable results of all research and investigations conducted under this grant, through dedication, assignment to the Secretary of Agriculture, United States of America, publication, or such other means as may be determined by the Director. Rights to patentable results in countries other than the United States of America shall be in accordance with the policy of the grantee, provided, that an irrevocable, nontransferable, and royalty-free license to practice such invention throughout the world be issued to the United States Government.

(a) With respect to patentable results in accordance with the foregoing paragraph, the grantee agrees:

(1) To cooperate in the preparation and prosecution of any United States patent application which the Department of Agriculture may decide to undertake covering the subject matter above described.

(2) To execute all papers requisite in the prosecution of such United States patent application including assignments to the United States and dedications.

(3) To secure the cooperation of any employee of the grantee in the preparation and the execution of any such papers as may be required in the prosecution of such United States patent application or in order to vest title in the subject matter involved in the United States, or to secure the right of free use in the public of the United States. It is understood, however, that the making of prior art searches, the preparation, filing, and prosecution of patent applications, the determination of questions of novelty, patentability, and inventorship as well as other functions of a United States patent attorney are excluded from the duties of the grantee.

Patentable research results arising from investigations financed by grant funds become the property of both the United States and the foreign research institution. The United States Department of Agriculture reserves the right to patent an idea in the United States where it will be made available for public use under established procedures. In such a case the grantee institution is expected to furnish necessary information to support the application. All costs for the United States patent will be borne by the U. S. Government. The

grantee institution may patent the same idea in its own and any other country except the United States. If the grantee institution does secure patents in countries other than the United States, provision must be made to permit the United States Government to use the patents without payment of royalties. This provision applies only to the U. S. Government and not to United States citizens, companies or corporations.

- (16) (b) Nonpatentable Results. Results of research or investigations and information concerning the project, which the Director determines will not form the basis of a United States patent application, shall be made known to the United States public in such manner as determined by the Director. Publication of such results in any country other than the United States shall be in accordance with the policy of the grantee, provided the U. S. Government may publish such results in any country should the grantee fail to do so. It is understood and agreed that manuscripts prepared by either party shall be sent to the other party when the article is submitted for publication. The party publishing the material shall include therein such credit or recognition of the contribution made by the other party as mutually agreed upon. (In the case of publication by the grantee, 100 reprints shall be supplied to the Director).

The policy applicable to manuscripts reporting the results of research conducted under grants is that the principal investigator and the institution are responsible for the preparation, editing, approval and publication of manuscripts. Manuscripts may be published in such manner as a grantee finds most appropriate and a grantee may publish manuscripts without first securing advice or comment from the scientists of the United States Department of Agriculture. The grantee has full responsibility for the interpretation of findings and for the accuracy of the results being reported. Recognition of the grant support for the research should be contained in an appropriate statement or footnote such as, "This research has been financed in part by a grant made by the United States Department of Agriculture, Agricultural Research Service."

- (17) Period of Grant. This grant shall take effect upon acceptance of the terms and conditions hereof by the grantee and shall remain in force and effect until completion of the work, but not to exceed years unless terminated as provided herein; provided; however, extension of time may be granted by the Director for good cause.

The period of the grant may not exceed the duration of the research project excepting that for good cause an extension of time may be granted by the Director.

- (18) Definitions. The term "Director" means the Director of the Foreign Research and Technical Programs Division, Agricultural Research Service, United States Department of Agriculture, and the term includes the authorized representative of the Director acting within the limits of his authority.

The definitions are self-explanatory.

A P P E N D I X

Specimen Research Proposals

Research Proposal in Biological Science

University of Valencia
Institute of Forest Research
Valencia, Spain

1a. Institution

University of Valencia, Valencia, Spain.

1b. Department or Laboratory

Department of Forestry - Professor H. M. Garcia, Head of Department. The Department of Forestry is staffed with 10 professionally trained foresters, many of whom have training in botany and other disciplines. A laboratory is available for physiological research and is well equipped. Part of a greenhouse is also available for research in tree physiology. Good library facilities are provided by the University.

1c. Principal Investigator in Charge of Project

L. A. Martinez, B.Sc., M.A., Ph.D. Professor of Forestry.

Background: University of Madrid, Madrid, Spain, M.A., with First Class Honors, 1938; University of Madrid, B.Sc., 1940; Research Fellow, Institute for Plant Physiological Research, Watermark, Holland, 1941-1943; Madrid University, Ph.D., 1946; Senior Lecturer in Forestry, University of Florence, Italy, 1954; Exchange Scientist, Chilean Government.

Publications:

L. A. Martinez, 1945, Studies of root growth in Pinus pinaster L.II. The relation between root growth and photosynthesis. Proc. Korrenkl. Ned. Akad. U. Uttermack, C45-122.

L. A. Martinez, 1946. Photosynthetic adaptation to light intensity in leaves of Fagus alba. Acta Bontanica Lolandica 6:321.

L. A. Martinez, 1946. On the role of light on root growth of American Oak seedlings. Med. V.d. handborrw. te Wagenigen 46 (15).

L. A. Martinez, 1950. Studies of leaf growth in Quercus rubra L.Vi. Further effects of the shoot system on root growth. Konikl. Akademik V. Wettenochappen C. 29, No. 3.

2. Title

The physiological process of aging in forest trees.

3a. Objective

To determine the physiological and biochemical factors involved in the change from a juvenile to a mature stage in perennial plants. This will provide a basis for manipulation of the tree to throw it into a juvenile or a mature stage.

3b. Importance of the work

Forest trees exhibit profound changes as they grow from seedlings to the mature tree and are harvested. Often the foliage is markedly different in the juvenile tree and in the mature tree. The character of the wood, its fiber length, the angle of the fibers and its density also change with age. Furthermore the ability for cuttings to root decreases with age of the tree so that the rooting of cuttings of old wood or from old trees is difficult or impossible. Finally during its maturation process, the tree changes from a vegetative to a reproductive state. There is some evidence that the state of maturity of the tree can be regulated to force a tree into a vegetative or reproductive state. This would be of great aid to foresters, particularly in research in forest genetics. To shorten the time between generations, usually 10 years or more, the stimulation of flowering of juvenile trees would be of immeasurable value. Also the promotion of the rooting of cuttings on mature trees would aid in preserving germ plasm of selected phenotypes. Only a few definitive studies have been aimed specifically at an understanding of the maturation process in trees.

Pertinent References

Schaffeletzky du Muckadell, M., 1954.

Juvenile stages in woody plants. *Physiologia Plantarum* 7: 782-996.

Lang, Anton, 1952. Physiology of flowering. *Ann. Rev. Plant. Physiol.* 3: 333-348.

Naylor, Aubrey W., 1952. Physiology of reproduction in plants. *Survey of Biol. Progress* 2: 259-300.

3c. Plan of Work

Methods of Investigation

1. Initial studies would be made with selected 2-3 year old plants of Spruce, Pine, and Oak, in an environment controllable as to rooting medium, temperature, light intensity, day length, and humidity. The wood properties examined would include fibre length, wood density, spring and summer wood development, and cell lumen size. The effects, on these properties, of the following factors would be studied:

- a. Variation in the carbohydrate balance of the plants and in translocation, induced by changes in night temperature and light intensity.
- b. Rate of cambial division, induced by locally applied temperature variation.
- c. Moisture level.
- d. Nutrition, in particular nitrogen and phosphate.
- e. Locally applied stresses. Hormone assays would be carried out in conjunction.

An attempt would be made to distinguish between direct effects of these factors and indirect effects due to differences in rate of growth and development.

2. Experimental Work on Older Trees.

Investigation of pole-stage and mature plantation-grown material would encompass the same field as in the case of young plants, but obviously, experimental methods would differ in some respects. Thus,

- a. Variation in the carbohydrate balance of trees would be induced by e.g., differential pruning, shading, and disbudding. Field measurements of photosynthesis would accompany these treatments.
- b. Variation in moisture level and nutrient status would be studied in plantations thinned to different intensities.
- c. The investigation of age effects on anatomical variation is also contemplated.

3. Work with Tissue Cultures.

Cultures of cambial tissue would be established on a small scale and the effects of carbohydrate and growth hormones on rate and pattern of cambial activity studied.

It is considered that the above studies would be sufficient to give a clue to the mechanisms controlling anatomical variations. The direction of further work would be determined by the results of the preliminary studies.

4a. Duration

Five years.

4b. Scientific Personnel Assigned

Three professional and two technical assistants per year.

5. Cost Estimates (in pesetas)

1. Salaries.....	3,779,707
2. Travel Within Country.....	50,393
3. Travel Outside Country.....	117,545
4. Transportation of Things.....	8,379
5. Rents and Utility Service.....	---
6. Other Contractual Services.....	21,845
7. Supplies and Materials.....	251,969
8. Non-expendable Equipment.....	503,938
9. Allowance for Indirect Costs (Lump Sum).....	<u>450,000</u>

Total for project (in pesetas)..... 5,183,776

Submitted by:

University of Valencia

Institute of Forest Research

H. M. Garcia, Head of Department of
Forestry

Date: June 20, 1958

Research Proposal in Physical Science

1a. Institution

Wellington Agricultural Research Institute, Cranmere, Devon, England.
J. R. S. Parkinson, M.A., Ph.D., Director.

1b. Department or Laboratory

Chemistry Laboratory, L. Graham, Ph.D., Head of Laboratory.

The Chemistry Laboratory, which was set up as an integral part of the institute on its establishment in 1946, is fully equipped for research in organic and inorganic chemistry and biochemistry. Recently, special facilities have been added for work with radioactive isotopes. The staff of the Laboratory consists of 11 scientists and a similar number of supporting personnel.

1c. Principal Investigator in Charge of Project

T. W. Lawes, B.Sc., Ph.D., Principal Scientist, Head of Cereal Chemistry Section.

Background: - (1) University of Liverpool, 1933-36: B.Sc. degree in chemistry (Class IIA Honours), 1936. (2) University of Liverpool, 1936-39: Postgraduate student; received Ph.D. degree in organic chemistry, 1939. (3) Imperial College of Science and Technology, London, 1939-40: Demonstrator, Department of Biochemistry. (4) Ministry of Food, 1940-45: Temporary Scientific Officer, Scientific Adviser's Division. (5) Imperial College, London, 1945-46: Assistant Lecturer, Department of Biochemistry. (6) University of Reading, 1946-51: Lecturer, Department of Agricultural Chemistry. (7) Wellington Agricultural Research Institute, 1951-present: Principal Scientist, Head of Cereal Chemistry Section, Chemistry Laboratory. Section comprises a Principal Scientist, 4 other scientists, and 4 technicians. Research programme includes studies of the chemical composition of wheat and oats, chemistry of gluten, and action of improvers.

Publications: - Publications include 11 papers on plant biochemistry. Among these are:

Lawes, T. W. Mode of occurrence of fatty acid derivatives in vegetable tissue. *Biochem. J.* 47, 324-349 (1939).

Lawes, T. W. Some fundamental considerations in the study of plant biochemistry. *Proc. 10th Internat. Conf. of Plant Biochem.*, Geneva, 1949, 330-360.

Lawes, T. W. Determination of amino acids in wheat endosperm: A new approach. *Nature* 168 (4377), 34-36 (1953).

2. Title

Isolation and identification of the non-saponifiable lipid constituents of the non-flour fraction of wheat, in order to provide data applicable to expanding the utilization of wheat and wheat products industrially and in feeds.

3a. Objectives

To obtain chemical and physical information on the presence of previously unidentified constituents of the non-saponifiable fraction of the lipids of the non-flour portion of the wheat berry, to develop and apply methods for the isolation of selected components, and to obtain preliminary evidence of their chemical nature, giving particular attention to those types of compounds that may be related to factors important in animal feeding, such as steroids.

3b. Importance of work

In present flour-milling practice, 25 to 28 percent of the wheat berry is a byproduct of flour manufacture. This comprises the bran, germ, and a portion of the endosperm which is incompletely separated in the milling process. This byproduct from flour milling is used primarily as feed; for example, approximately half of the more than 5 million tons of millfeed produced in the United States in 1947 was used by the formula feed industry (1). In addition, a variable amount of wheat itself (about 10 percent in 1952) is used as feed for livestock and poultry.

The chemical composition of the non-flour portion of the wheat berry is incompletely known, although the constituents present are of direct importance in the use of the flour milling byproducts as feeds. Many of the known nutritionally-important factors in wheat, including protein and the vitamins thiamin, riboflavin, niacin, and vitamin E, occur in highest concentration in the non-flour fraction.

Both the germ and the bran of wheat contain appreciable amounts of oil, generally about 12 percent and 4 percent, respectively. From the standpoint of animal feeding, the germ has received considerable attention, particularly in connection with the presence of vitamin E (tocopherol) in the oil. This vitamin is necessary for reproduction and certain other functions in poultry and other animals (2) and has been credited with the curative effect of wheat germ on "stiff lamb disease." Wheat germ oil also has been shown to contain ergosterol, a precursor of the antirachitic vitamin D. Recent studies on the sterol fraction of wheat germ oil demonstrated the presence of several (Δ^7)-sterols, of which one was identified and shown to comprise about 3 percent of the total sterols of the germ oil (3). This class of sterols is of interest as possible intermediates in the production of sterols having the biologically important 11-keto group present in some sterols having hormone activity.

Evidence of unknown factors of nutritional importance in wheat germ or wheat germ oil has been provided by various feeding experiments. Detection of estrogenic activity in wheat germ oil suggests the presence of sterols of the sex hormone type. The beneficial effect of wheat germ oil on reproduction for cows and pigs has recently been attributed, at least in part, to unidentified constituents in addition to vitamin E.

More complete knowledge of the chemical composition of wheat is a necessary foundation for the development of new or improved uses for this grain. As a contribution to this foundation, the present research proposal is directed toward the study of the composition of the non-flour fraction of the wheat berry. The significance of the study is emphasized by the fact that flour milling is by far the major outlet for wheat.

In view of the relatively high oil content of the non-flour fraction of wheat, together with existing evidence of factors in wheat germ oil of importance in animal nutrition, it is apparent that more complete knowledge is needed concerning the chemical composition of the lipid or oil of the total non-flour fraction. This knowledge will be of importance not only as concerns use of the millfeed byproducts as a whole from flour milling, but also from the standpoint of improved utilization of the germ and bran fractions therein, or of the oil from these components.

The unsaponifiable fraction of the lipids has been selected for first attention because therein are found types of compounds which presently are recognized to be of importance in animal feeding, such as vitamin E, ergosterol, and other sterols. Particular attention will be given to the possible presence of chemical compounds closely related to the physiologically-active factors. Such related compounds often are inactive or of lower activity, yet give similar chemical reactions, so that attempts to measure the amount of active vitamin or growth factor by chemical methods, which are convenient, often give misleading and erroneous results.

Pertinent References

- (1) Northwestern Miller, Almanack Number, April 27, 1954.
- (2) Morrison, F. B., Feeds and feeding, 21st Edition. Morrison Publishing Company, Ithaca, N. Y., U.S.A., 1948.
- (3) Idler, D. R., Kandutsch, A. A., and Baumann, C. A., Isolation of (δ)⁷-stigmasterol from wheat. J. Am. Chem. Soc. 75, 4325-4327 1953.
- (4) Eggitt, P. W. and Ward, L. D., The chemical estimation of vitamin-E activity in cereal products. II. Millers' offals and compound animal foods. J. Sci. Food Agric. 6, 329-337 (1955).

3c. Plan of Work

The non-saponifiable fraction of the non-flour portion of the wheat berry will be separated into fractions on the basis of the class behavior of the constituents, using such properties as solubility characteristics, functional groups, complex formation, and chromatographic behavior as bases for separation. Each fraction will be investigated qualitatively to obtain evidence concerning the possible presence of previously unreported or unidentified constituents, by use of such techniques as adsorption and partition chromatography, countercurrent distribution, and specific color and precipitation reactions. Where new constituents are detected, attention will be directed

to the development and application of methods for their isolation in sufficient quantity for further study. Determinations of the chemical nature of such compounds will be initiated and completed insofar as possible in the time allotted for carrying out the project.

4a. Duration

5 years.

4b. Scientific Personnel Assigned

8.0 professional man-years per year.

5. Cost Estimates (in British pounds)

1. Salaries.....	31,500
2. Travel Within Country.....	400
3. Travel Outside Country.....	500
4. Transportation of Things.....	100
5. Rents and Utility Service.....	150
6. Other Contractual Services.....	300
7. Supplies and Materials.....	500
8. Non-expendable Equipment	
Infra-red spectrometer 1/2 (£450).....	225
Gas-phase chromatography assembly 1/2	
(£530).....	265
Paper electrophoresis apparatus 1/2 (£420).....	210
9. Allowance for Indirect Costs (18%).....	5,931
(An appropriate percent of	
items 1,2,4,5,6 & 7)	
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Total for project (in British pounds)	40,081

Submitted by:

Wellington Agricultural Research Institute

J. R. S. Parkinson, Director

Date: May 13, 1958

U. S. DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE FOREIGN RESEARCH AND TECHNICAL PROGRAM DIVISION RESEARCH PROGRESS REPORT - P. L. 480	1. TOTAL AMOUNT OF GRANT £40,000	2. PREVIOUS AMOUNT PAID £9,500	3. PROJECT NO.
	4. AMOUNT OF CURRENT PAYMENT REQUESTED £ 1,800	5. GRANT OR CONTRACT NO. FG-UK-158	
6. NAME OF INSTITUTION Wellington Agricultural Research Institute Cranmere, Devon, England	7. REPORT PERIOD		8. REPORT NO.
	A. FROM 12-1-59	B. TO 5-31-60	4

9. PROJECT TITLE

A fundamental study of the microbiological breakdown of natural cotton fiber.

10A. SIGNIFICANT FINDINGS (If any)

The extracellular extract from A. menensis appears to contain a small quantity of an enzyme which can reduce the strength of cotton yarn practically to zero but is expended in so doing.

10B. SUMMARY OF PROGRESS (Give concise summary of progress for this report period.) (If additional space is required, use FRTF Form 5B)

The work during this period has progressed chiefly along two lines. First, ways have been examined by which the extracellular filtrates from A. menensis can be used most effectively to produce degradation of unmodified cellulose. Secondly, as it is possible that most of the enzyme responsible for extensive degradation of unmodified cellulose remains firmly bound to its substrate, methods are being developed by which it is hoped to recover this enzyme in active form.

In the last Progress Report it was mentioned that 13 successive daily treatments of a yarn sample with fresh culture filtrates of A. menensis cellulase reduced its strength by 75%. This work has now been extended using a single large batch of culture filtrate which was kept sterile with sodium pentachlorophenate, stored at +2° and used as required. Eighteen successive daily treatments with this solution reduced the strength of a cotton yarn by more than 95%. To the best of our knowledge this is the first time that this has been achieved with a cell-free cellulase preparation on unswollen cotton cellulose. The damage visible on the degraded material was typical of that seen on cotton after attack by fungus. As the significant factor involved in producing this extensive degradation could have been the quantity of enzyme employed, and not the method of application, we examined the action of twenty times the volume of enzyme, at the same concentration. The same amount of attack was produced on the first day, followed by slightly more on each of the following 3 days, than by the successive treatments. After about 6 days, when some 70% of the strength had been lost, the action slowed down and thereafter lagged well behind that produced by an equivalent number of successive daily treatments. The effect of enzyme concentration was examined further and, as shown previously for higher concentrations, the rate of the initial attack was higher and the extent of attack greater, the greater the concentration. Neither effect, however, was in proportion to the concentration of enzyme used. From all of these experiments it was concluded that the most effective way of using a culture filtrate was as successive treatments, without concentration or purification. The possibility of using shorter treatments has not yet been examined in detail, but in a single experiment lasting one week in which continuous, very slow, irrigation was used, about 50% of the yarn strength had been lost which is of the same order as for seven daily treatments.

11. SIGNATURE OF PRINCIPAL INVESTIGATOR IN CHARGE (Signed) J. K. Bendix	12. DIRECTOR OF RESEARCH INSTITUTION (Signed) M. L. Dogood
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RESEARCH PROGRESS REPORT - P. L. 480 (Continuation Sheet)

REPORT PERIOD

FROM

12-1-59

TO

5-31-60

SUMMARY OF PROGRESS (Continued)

This work will be extended to chromatography of cellulase preparations on cellulose columns and it is hoped to interpret the separation of the activities towards carboxymethylcellulose and cotton yarn in terms of the "A and B" theory.

Concerning the encouragement of even growth of A. menensis on cotton cloth for respirometric studies, it was stated in the last report that the effect of a filtrate from a culture of A. menensis to promote rapid and even development of the fungus from spores might be due to the provision of a soluble source of carbon. This has been shown to be untrue, for it is not reproduced by the addition of an equivalent quantity of glucose to the spore-suspension. It has also become evident that spores from different cultures vary greatly in their tendency to clump; filtration of a spore-suspension through a sinter of porosity 2 to remove clumps sometimes removes most of the spores. This problem remains to be solved.

Work to develop a technique for recording photographically the progress of digestion of cotton by A. menensis has continued. The object is to observe the behaviour of only a few spores in the vicinity of cotton fibers during germination and growth for at least 7 days. The difficulties are to keep spores, mycelium and cotton hair in the same optical plane, and to keep the fungus alive under the cover glass i.e. allow for air exchange, and yet keep infection out. The most successful method so far has been to pour a very thin layer of mineral medium agar over the base of a specially prepared slide. Sterile cotton fibers were placed on the agar and the area was then inoculated with a drop of a spore-suspension of A. menensis spores. A large cover glass, pressed on this drop, scatters the spores all over the agar. A suitable area with a few single spores and some cotton fibers in the field of view can then be selected and photographs taken at regular intervals.

1. FROM (Name & address of grantee)

2	GRANT NO.
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3. AMOUNT OF GRANT

4. REPORT NO.

4

5. REPORT PERIOD

FROM
Dec. 1, 1959

TO
May 31, 1960

6 PROJECT TITLE

SUMMARY STATUS OF FUNDS	AMOUNT
7. TOTAL GRANT FUNDS RECEIVED	£ 11,300
8. TOTAL GRANT FUNDS SPENT INCLUDING THIS REPORT PERIOD	10,104.4.8
9. BALANCE GRANT FUNDS END OF THIS REPORT PERIOD (Item 8 from Item 7)	1,195.15.4
10. ESTIMATED FINANCIAL REQUIREMENTS UNDER GRANT FUNDS FOR NEXT PERIOD (Explain any unusual expected costs by attaching statement)	3,200

11. DIRECT COSTS FOR ALL PERSONS WORKING ON PROJECT:

NAME AND TITLE

AMOUNTS CHARGED TO GRANT FUNDS

254. 6. 6

692.13. 3

451. 2. 1

583.11.11

110.15. 5

97. 1. 7

12. TRAVEL OF PERSONNEL WITHIN COUNTRY

37.17. 1

13. SUPPLIES AND MATERIALS AND OTHER DIRECT COSTS (Explain unusual cost items)

164.10

14. TOTAL (Add Items 11 through 13)

2391.17.10

15. INDIRECT COSTS (Agreed allowance or percent of Item 14) $15\% \times \text{item 14}$

358. 9. 8

16. NON-EXPENDABLE EQUIPMENT APPROVED UNDER GRANT	Microscopy Equipment	£98.6.4	50%
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49. 3. 2

17. APPROVED TRAVEL OUTSIDE COUNTRY

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18. TOTAL GRANT FUNDS SPENT FOR REPORT PERIOD (Add Items 14 through 17)

2799.10. 8

19. INTEREST EARNED ON GRANT FUND DEPOSITS, IF ANY

We certify that the amounts reported spent from grant funds are in accordance with the provisions applicable to the above identified grant.

20A. TITLE

20B. SIGNATURE OF PRINCIPAL INVESTIGATOR

20C. DATE

(Signed) P. L. Lovejoy

June 10, 1960

21A TITLE

21B SIGNATURE OF OFFICIAL AUTHORIZED TO SIGN FOR GRANTEE

21C. DATE	
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(Signed) M. L. Dogood

June 11, 1960

